Attachment 3
Cathodic Protection Survey Procedure
For Underground Storage Tank Inspections

March 2006

Introduction

The limited survey of cathodic protection (CP) systems required as part of a regular UST compliance inspection does not need to be overly involved, but it must be conducted in a manner that is accurate, repeatable and defensible. Ensuring that UST systems are adequately protected from corrosion is vital for leak prevention. A tank or line that is corroding will soon be leaking. CP does not stop corrosion, but is merely a tool for mitigating corrosion. Since metallic system components protected by CP are still corroding – they will eventually fail, but at a much slower rate if protected by a CP system that is adequately designed and properly maintained. The goal of the CP survey is to ensure systems meet current industry standards demonstrating adequate protection from corrosion.

NACE International's standard test method TMO101-2001 is currently the most inclusive and scientific CP test method for USTs. The following procedures are based on the criteria in this test method. However, the procedure below is not as inclusive, as the intent is to merely determine if the system is operational, not to fully trouble-shoot and repair CP systems.

All aspects of the survey and any site conditions that might affect system operation must be clearly documented.

A. Make note of the following:

1. CP system type – impressed current (IC) or sacrificial anode;
2. Rectifier model and settings (gauge readings can be verified with a multi-meter);
3. Any adverse site conditions (very dry soil, high water table, broken wires, recent concrete work, etc.).

B. Prepare a site sketch showing (see end of document for example):

1. Anode location for IC systems;
2. How and where structures are bonded to the rectifier if visible (vents or product piping in sumps);
3. CP test port locations if provided and if they fully penetrate the concrete/asphalt. When test ports are not provided, note where you made soil contact over the structures.

C. Conduct the survey:

1. Make good contact to the structure to be tested – tank bottom – with the positive meter lead.
2. Make soil contact over the structure to be tested with a properly maintained copper/copper sulfate reference electrode (CSE) connected to the negative meter lead (marked as "common" on most meters). (Making soil contact remotely may introduce an additional IR drop error into your potential readings.

3. Record "On" potentials at all provided test ports or at available soil access points over the structure being tested – avoid shielding if using manways (CSE must extend below the skirting) – no additional IR drop consideration is necessary for galvanic systems provided the CSE is properly placed.
4. Before moving to the next tank, contact the tank riser with the positive meter lead and record the reading. This can help verify tank construction – bare steel or stiP3.
5. If you are testing an IC system, go back to the points with the most positive potentials (one or two points) and take an "Instant Off" reading. The large IR drop inherent in IC systems MUST be accounted for to evaluate system operation. The "Instant Off" criteria is the simplest method to account for this large IR drop. Contractors may use different methods.
6. Be sure to test all protected structures. Often flex connectors have galvanic anodes attached to prevent corrosion failure.
7. If testing a stiP3 tank with IC added, a continuity check should be performed. Place the CSE remotely (IR drop is not a consideration for this check) and roughly equal distance from each tank. Then contact each tank bottom without moving the CSE. The noted potentials should not vary more than 2 mV (.002V) or the tanks are not continuous. This is important as a stray current situation could exist that will result in rapid loss of tank metal and failure of the tank. (Under stray current conditions metal loss for carbon steel is 20 pounds per amp per year).

D. Presenting results and system evaluation:

1. Record potential readings in tabular form, making sure to note polarity (+ or -), the units of measure V or mV, and if the reading is an "On" or "Instant Off" reading;
2. Note soil contact points on the sketch;
3. The industry standard used to demonstrate adequate protection of carbon steel in a soil or fresh water environment is .850V (-850mV) in reference to a CSE with all IR drop considered other than that across the tank to electrolyte interface:

    a. If readings are more negative than -.850V considering other IR drops, (Instant Off for IC systems – On for galvanic systems provided the CSE is properly placed), the structure should be adequately protected. Instant Off readings of -1.2V or more negative may indicate a situation where coating disbondment or stray current issues could result. Such readings should be recorded and also brought to the owner/operator's attention;
    b. If readings are close, (around -.840V), the site conditions may explain the situation, (dry soil, etc.), and the system may be adequately protected;
    c. If readings indicate inadequate protection, (-.830V or more positive), inform the owner/operator of your findings in the inspection report.

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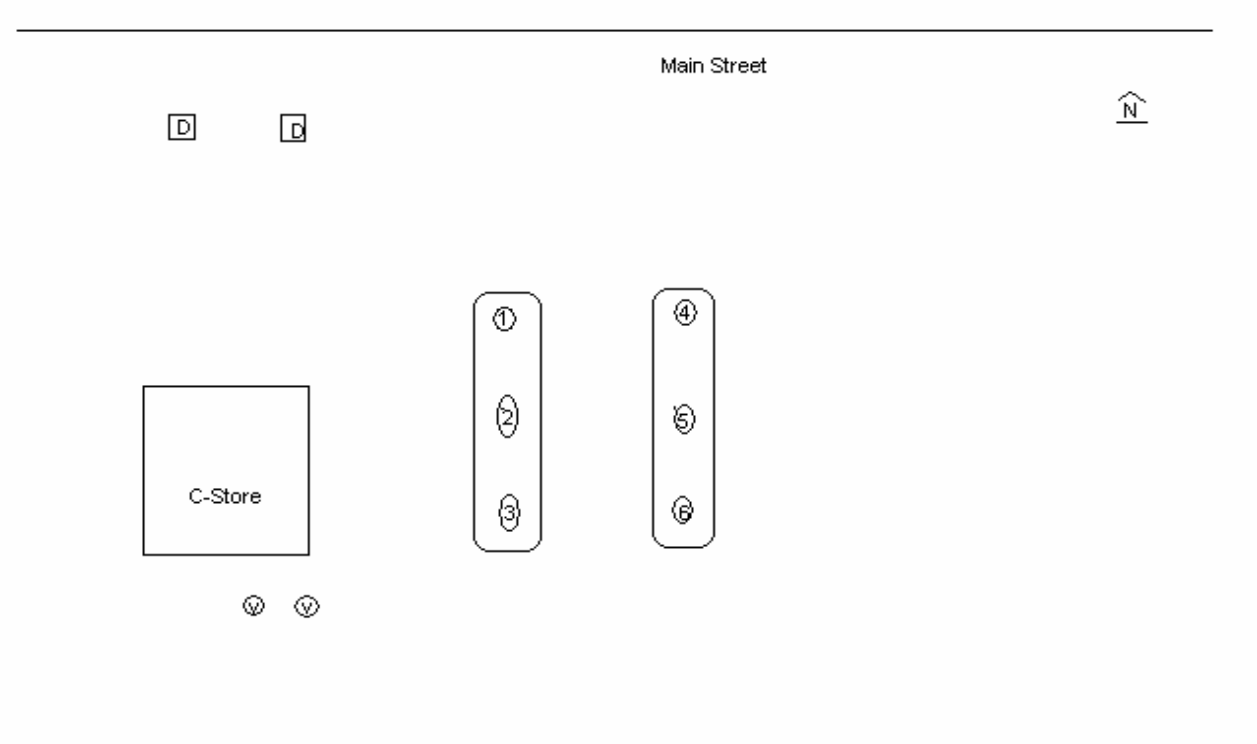
Example sketch and survey results with conclusions:



CP Survey – Structure contact made to bottom of tank and soil contact made with CSE at CP test ports indicated on sketch. Universal rectifier – tap settings C-2 and F-3, 0.6 V by gauge (shunt .2amp/mV. meter reading of 4mV or 0.8 amp output by shunt). Flexes had heat shrink boots only, no CP.

Example #1

1 = -.975V on & -.975V riser

2 = -.998V on
3 = -.816V on & -.748V IO
4 = -.901V on & -.901V riser
5 = -.794V on
6 = -.712 V on & -.699 V IO

Example #2

1 = -.975V on & -.848 V IO (riser -.900V on)

2 = -1.003 V on
3 = -.991 V on
4 = -1.06V on & -.860V IO (riser -.844V on)
5 = -1.08V on
6 = -1.31V on & -.944V IO

Conclusions: In example #1 the tanks are not adequately protected and the CP system must be repaired/adjusted as necessary. In example #2 the tanks appear to be adequately protected but may be stiP3 tanks, therefore a continuity check should be performed. If the tanks are stiP3 neither the instant off or the 100mV polarization shift criteria are applicable and another method of accounting for the IR drop must be used.